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UNIVERSITY OF CALIFORNIA

LAWRENCE RADIATION LABORATORY
BERKELEY 4, CALIFORNIA

June 2, 1964

Prof. Joshua Lederberg
Space Science Board
800 Welch Road - Suite 214
Palo Alto, California

Dear Prof. Lederberg:

Your letter of May 20, 1964 leaves me puzzled as to the purpose of the concensus you are seeking with respect to the search for extraterrestrial life. This area is not one in which I have done any appreciable reading or thinking. I do not feel that at this time I would be able to make a meaningful contribution in comparison with those who have been more closely involved with the project.

I am sure that my suggestions for "first drafts of analytical systems" based on visible spectrometry and the use of polarized light would be naive in comparison with those of qualified scientists actually working in the area of exobiology. The very basic issue as to what attributes should be sought to characterize extraterrestrial life is not clear in my mind. It seems fruitless for me to propose analytical schemes when the questions they are designed to answer are ill formulated for me. With a chunk of Mars in an earthbound laboratory a few initial observations would quickly lead to the design of fruitful experiments, where we could call in the appropriate tools as needed. The design of rocket-based instrumentation is so closely hedged with technical considerations that it seems overwhelming to an uninitiated laboratory scientist like myself.

The detection of life as we know it here on earth is a problem more approachable, if more mundane. A biological system which derives its energy ultimately from sunlight does this by absorption of light by pigments (e.g. chlorophyll, carotenoids, etc.) In the Martian environment somewhat more of the electromagnetic spectrum is presumably available for this purpose than is the case on earth. (At the same time the potential hazards of high-energy radiation must be provided against). To my knowledge, the only "pigments" in our earthly environment which are soluble (extractable) in organic solvents, such as petroleum ether or acetone, are those produced by living organisms. Colored mineral substances do not have this property. In your article "Signs of Life", you state as a typical sensitivity criterion the ability to detect 10 nanomoles of a particular compound. The methods of visible spectroscopy could readily detect such amounts of pigments such as chlorophyll, or unknown ones with comparable absorptivities. One milliliter of an organic solution containing 10 nanomoles of such a pigment would have an optical density of 1 for a 1 cm path length. The instrumentation to carry out such an extraction and measurement should be quite straight forward. Any form

of life which would not be detectable by this method, except that there is an insufficient amount in the dust collected, would be very different from what we know on earth. To my mind, systems which do not derive their energy directly form sunlight could only exist in company with those which do. Furthermore, the energy storing ability seems much more basic to me as a criterion for life than such characteristics as optical activity or specific morphological manifestations. The presence of "colored", organic-soluble compounds is also a more rigorous criterion than is the presence of infrared absorption bands characteristic of carbon-based molecules in general. We already know that these latter can be readily prepared abiogenically in the laboratory.

Suggestions such as the one above are, I am sure, already being pondered by those more closely associated with the technical aspects of the life-detection program. Without a meaningful background in the subject, I am unable to present ideas with the requisite level of sophistication to be useful as concrete proposals. This is certainly a field in which one must expend a major portion of his energies in order to obtain a significant achievement. Unfortunately, that is an expenditure that I am unprepared to make. Under the circumstances, I feel that any more extensive speculations of this nature on my part would be a substantial prodigality of your time and mine. I am sure you are as well aware as I am that what such a project requires above all is a lot of good hard work by dedicated and clear-thinking individuals.

Very truly yours,

Kenneth Sauer

Kenneth Sauer
Assistant Professor of Chemistry

KS/bs